

## COMPARATIVE STUDY BETWEEN CONVENTIONAL FOUR PORT LAPAROSCOPIC CHOLECYSTECTOMY VERSUS SINGLE INCISION LAPAROSCOPIC CHOLECYSTECTOMY

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### ABSTRACT

#### BACKGROUND

Laparoscopic cholecystectomy is the standard procedure for gall stone disease. Traditionally, it is performed using multiple small sites. With the introduction of notes, single incision laparoscopic surgery has emerged as an alternative technique to improve cosmesis and minimise complication associated with multiple incisions.

#### MATERIALS AND METHODS

This study was conducted in SCB Medical College, Cuttack from July 2013 to September 2014. A total of 60 patients undergoing laparoscopic cholecystectomy was taken up for this study. 30 patients underwent SILC and 30 underwent four port laparoscopic cholecystectomy (4 PLC). All intraoperative and postoperative parameters were compared between these two groups.

#### RESULTS

The incidence of intraoperative complications were similar in both groups. The duration of surgery was more in SILC. The postoperative pain was less in SILC and the wound length was significantly short in SILC when compared to 4 PLC.

#### CONCLUSION

SILC is a better choice for the patient in experienced hands, but simultaneously experience in 4 PLC is inevitable.

#### KEYWORDS

Four Port Laparoscopic Cholecystectomy, SILC.

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#### BACKGROUND

Cholecystitis is the inflammation of the gall bladder. It presents with symptoms like pain in the right hypochondrium, vomiting and fever. Complications include gall stone pancreatitis, inflammation of common bile duct. Treatment usually requires surgical removal of gall bladder. In 1882, Langenbuch first conducted elective cholecystectomy.<sup>1</sup> Since then open cholecystectomy has been the standard procedure for cholecystitis till 1980 with mortality rate of less than 1% and bile duct injury of 0.1% - 0.2%.<sup>2,3</sup> Following the introduction of laparoscopic surgery, Muhe in 1980 performed laparoscopic cholecystectomy<sup>4</sup> for the first time. The laparoscopic cholecystectomy has become a plausible alternative due to its advantage of shorter hospital stay, less pain and smaller scars.<sup>5</sup> Advancement in laparoscopic field allowed the possibility of laparoscopically managing common bile duct stone by choledochotomy

expanded laparoscopic surgery in treatment of biliary disease.

Single-incision laparoscopic surgery or SILS refers to the operative technique in which a surgical procedure is carried out through one incision, alternatively it is also known as Laparoendoscopic Single Site (LESS) surgery. In 1997, Navarra et al described a single-incision laparoscopic cholecystectomy as a plausible alternative procedure to the four-port laparoscopic cholecystectomy.<sup>6</sup>

This study is a comparison between conventional 4 port laparoscopic cholecystectomy and Single Incision Laparoscopic Cholecystectomy (SILC) in terms of the patient selection, operative procedure, complication, outcome and followup in patients admitted to SCB Medical College and Hospital during the period June 2012 to September 2015.

#### Aims and Objectives

The aim of this study is to compare the effectiveness, advantages and disadvantages of conventional four port laparoscopic cholecystectomy versus single incision laparoscopic cholecystectomy for symptomatic gallstone disease.

#### Types of Intervention

- 4 port Laparoscopic cholecystectomy.
- Single incision laparoscopic cholecystectomy.

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### Types of Outcome Measures

- Duration of surgery.
- Difficult Calot's dissection.
- Intraoperative bleeding.
- Common bile duct injury.
- Conversion to other procedure.
- Postoperative pain less than and more than 12 hours.
- Erythema.
- Seroma.
- Port site hernia.
- Mortality.
- Wound length.
- Length of hospital stay.
- Cost of procedure.

### MATERIALS AND METHODS

1. The Study will be conducted in the Dept. of Surgery of S.C.B. Medical College, Cuttack. (July 2013 - September 2014).
2. Patients will be selected from those admitted to Department of General Surgery, S.C.B. Medical College Cuttack and undergoing Laparoscopic cholecystectomy.

### Inclusion Criteria

- a) Patients of any age.
- b) Patients undergoing Laparoscopic cholecystectomy.
- c) Patient willing to give informed consent.

### Exclusion Criteria

- a) Patient with bleeding disorder, generalised peritonitis, cholangitis, COPD, congestive heart failure and those who underwent previous upper abdominal surgery.
- b) Patients undergoing open cholecystectomy.
- c) Patient unfit for surgery under general anaesthesia.

Sample Size- Number of patients to be studied are 60.  
Statistical Analysis of my study will be by standard- 't' test, chi-square method.

### METHODOLOGY

Patients admitted to our hospital and who were fit for Laparoscopic cholecystectomy were exclusively studied in this prospective study. After proper pre-operative evaluation, patients are to be subjected for either conventional 4 port laparoscopic cholecystectomy or SILC. Patient selection, operative procedure in terms of time taken to complete, technical difficulties faced, complications encountered, outcome and followup were studied in detail. Data collected will be subjected to compare between the above mentioned two techniques and to prove the superiority of one over another.

### Preoperative Preparation

All patients were immunised against tetanus toxoid on admission. Patient is kept nil per oral for 12 hours before surgery.

**Anaesthesia-** Patients were administered general anaesthesia.

**Operative Procedure-** Conventional 4 port laparoscopic cholecystectomy-

Step One- Creation of pneumoperitoneum as well as insertion of trocars.

Step two- dissection in Calot's triangle done by releasing the adhesions of gall bladder with liver, following which the cystic duct and the cystic artery identified.

Step three- Cystic artery and the cystic duct is occluded with LA LIGA clips and divided.

Step four- Extraction of the gall bladder from the liver bed with hook. Ryle's tube is placed in Morrison's pouch as a drain. Drain is fixed and all ports closed.

### Postoperative Management

After completion of the procedure, the nasogastric tube is removed. All patients were observed in recovery room for an hour, after which they were shifted to ward. All patients are administered IM analgesics the night after surgery.

All patients were started on oral feeds around 6 hours after surgery. The drain was removed by day 2 and most patients were discharged on the 2nd post-operative day.



**Figure 1. Laparoscopic Instruments used for Cholecystectomy**



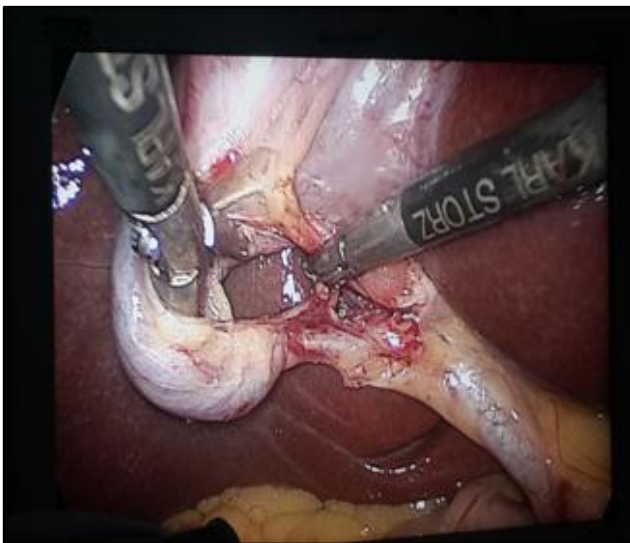
**Figure 2. Creation of Pneumoperitoneum**



**Figure 3. Port Positions for 4 PLC**



**Figure 6. Gall Bladder Retrieval**



**Figure 4. Calot's Dissection**



**Figure 7. Post-Operative Image**



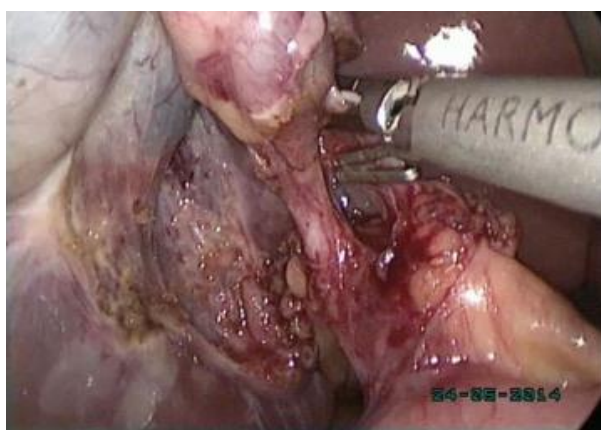
**Figure 5. Clipping of Cystic Artery and Duct**



**Figure 8. SILC Port Position**



**Figure 9. Fundus Traction through External Sutures**



**Figure 10. Clipping of Cystic Artery in SILC**



**Figure 11. Gall Bladder Retrieval in SILC**



**Figure 12. Post-Operative Image in SILC**

**Single Incision Laparoscopic Cholecystectomy-**

SILC was performed in stages.

Stage I- Transumbilical 2 cm incision.

Insufflation of the abdomen with CO2 using Veress needle at 12 - 15 mmHg.

Placement of two 5 mm trocar in the umbilicus.

Placement of a 45 angle 10 mm scope.

Stage II- Exposure.

Endo-stitch was used to anchor the fundus of the GB to the abdominal wall using Endo-close.

Placement of the Veress needle in the epigastric area to retract the liver and open the triangle of Calot.

Endo-stitch was used to place a suture in the infundibulum and pulling the ends through the abdominal wall laterally and medially using the Endo-close.

Endo-close was used to push the fundus of the GB above the liver.

Stage III- Using the standard straight dissector with slight curved tip cystic duct and cystic artery were dissected.

Placement of suture around cystic duct using Endo-stitch.

5 mm clip applicator used to clip the cystic duct and cystic artery.

Transaction of both structures done.

Stage IV- Dissection, Haemostasis and Cleaning.

Dissection of the gallbladder from the liver bed using electrocautery.

Veress needle used to assist in exposure.

Haemostasis using ball tip cautery.

Irrigation with saline.

Stage V- Extraction and wound closure.

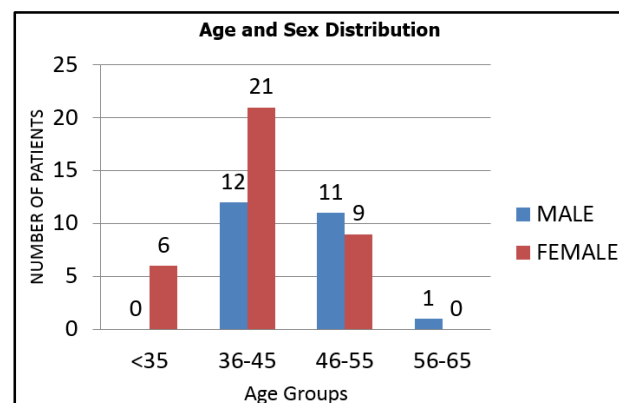
Pulling the suture of the infundibulum through the upper 10 mm trocar.

Placement of a 10 mm tooth grasper to grab the Gallbladder.

Extraction of the gallbladder through the umbilicus holding on the suture of the infundibulum.

**OBSERVATION**

Sixty patients of cholelithiasis were taken up for study at the S.C.B Medical College and Hospitals, Cuttack during the period of July 2012 and September 2014. Those cases were admitted to the Department of Surgery and following were observed.



**Graph 1. Age and Sex Distribution**

Age in Years	Male	Percentage	Female	Percentage	Total	Percentage
< 35 Yrs.	0	0%	6	16.7%	6	10%
35 - 45	12	50%	21	58.3%	33	55%
46 - 55	11	45.8%	9	25%	20	33.3%
56 - 60	01	4.2%	0	0%	01	1.7%
<b>Total</b>	<b>24</b>	<b>100%</b>	<b>36</b>	<b>100%</b>	<b>60</b>	<b>100%</b>

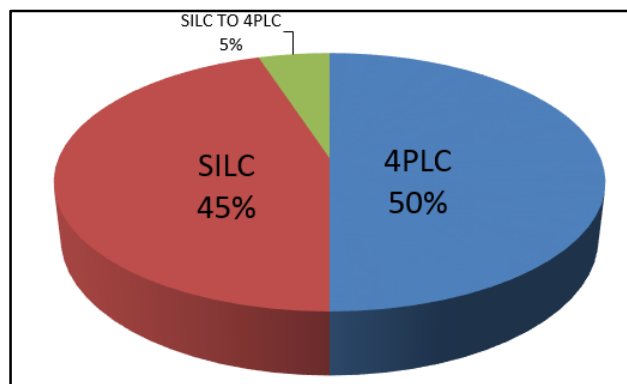
**Table 1. Age and Sex Distribution**

Below 35 years there were 6 females and no male, between 36 - 45 years there were 21 females and 12 males, between 46 - 55 years there were 9 females and 11 males, between 56 - 65 years there was 1 male and no female.

In this study, the peak incidence of cholelithiasis was between 36 - 45 years. Out of 60 cases under study 40% are males and 60% are females, incidence of 1:1.5 (M:F) showing female predominance.

Type of Surgery	Number of Patients	Percentage
4 Port Laparoscopic Cholecystectomy (4 PLC)	30	50%
Single Incision Laparoscopic Cholecystectomy (SILC)	27	50%
SILC → 4 PLC	03	
<b>Total</b>	<b>60</b>	<b>100%</b>

**Table 2. Total Number of Cases and Procedure Undertaken**

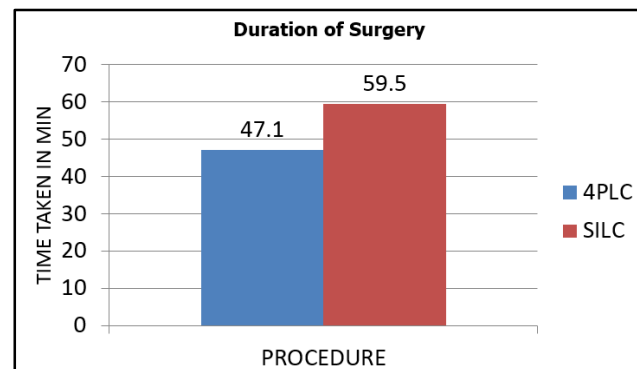


**Graph 2. SILC to 4 PLC**

Out of sixty cases 30 cases underwent 4 PLC and 30 cases underwent SILC, of which 3 cases were converted from SILC to 4 PLC due to difficult Calot's dissection.

Procedure	Mean Operative Time (Plus or Minus SD)	P Value (T Test)
4 Port Laparoscopic Cholecystectomy (4 PLC)	47.1 ± 1.9	P < 0.0001 (Significant)
Single Incision Laparoscopic Cholecystectomy (SILC)	59.5 ± 6.9	

**Table 3. Duration of Surgery**



**Graph 3. Duration of Surgery**

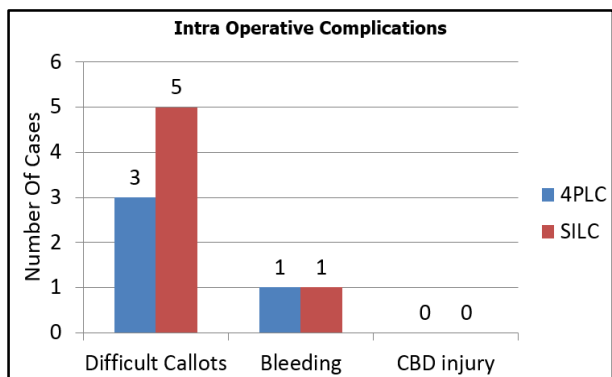
The time taken to complete 4 PLC was on an average 47.1 + 1.9 min and for SILC it was clearly more (i.e.) 59.5 + 6.9 and the P value was < 0.0001, which is significant.

Procedure	Difficult Calot's Dissection (Number of Cases)	P Value (Chi-Square Method)	Bleeding (Number of Cases)	P Value (Chi-Square Method)	CBD Injury (Number of Cases)
4 PLC	3	P 0.4782 (Not Significant)	1	P 0.9805 (Not Significant)	0
SILC	5		1		0

**Table 4. Intraoperative Complications**

Type of Conversion	Number of Cases Converted
4 PLC to Open Cholecystectomy	0
SILC to 4 PLC	3

**Table 5. Conversion**



**Graph 4. Intraoperative Complications**

During surgery, difficulty in Calot’s dissection occurred in 3 cases of 4 PLC and 5 cases of SILC. Of 5 cases, 3 of them were converted to 4 PLC. Bleeding was encountered in 1 case, both in 4 PLC and SILC group and there was no CBD injury in either procedures. P value calculated by Chi-Square method showed insignificance between 4 PLC and SILC as for intraop complication is concerned.

**Graph 5. Mean Postoperative Pain Score < 12 Hrs.**

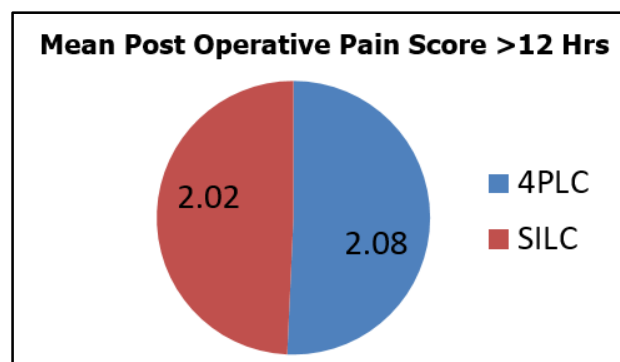
Postoperatively, the mean pain score < 12 hrs. was 5 in those who underwent 4 PLC and it was 2.5 in those who underwent SILC and the P value calculated by t-test is <0.0001, which is statistically significant.

Procedure	Mean Pain Score (Plus or Minus SD)	P Value (T Test)
4 Port Laparoscopic Cholecystectomy (4 PLC)	2.08 ± 0.19	P = 0.0879 (Not Significant)
Single Incision Laparoscopic Cholecystectomy (SILC)	2.02 ± 0.09	

**Table 7. Postoperative Pain > 12 Hours**

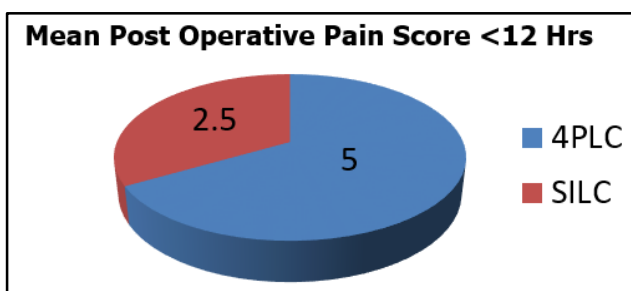
Procedure	Mean Pain Score (Plus or Minus SD)	P Value (T Test)
4 Port Laparoscopic Cholecystectomy (4 PLC)	5 ± 0.4	P < 0.0001 (Significant)
Single Incision Laparoscopic Cholecystectomy (SILC)	2.5 ± 0.4	

**Table 6. Postoperative Pain < 12 Hours**



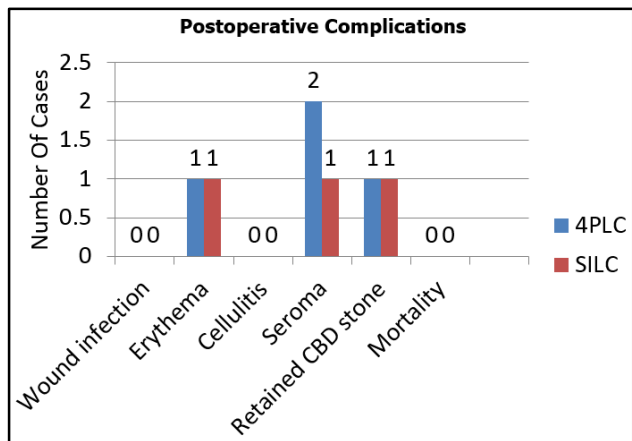
**Graph 6. Mean Postoperative Pain Score > 12 Hrs.**

The mean pain score > 12 hours was 2.08 + 0.19 in 4 PLC group and 2.02 in SILC group and the P value is 0.087 which is insignificant.



Procedure	Wound Infection	Erythema	Cellulitis	Seroma	Retained CBD Stone	Mortality
4 PLC	0	1	0	2	1	0
SILC	0	2	0	1	1	0

**Table 8. Other Postoperative Complications**

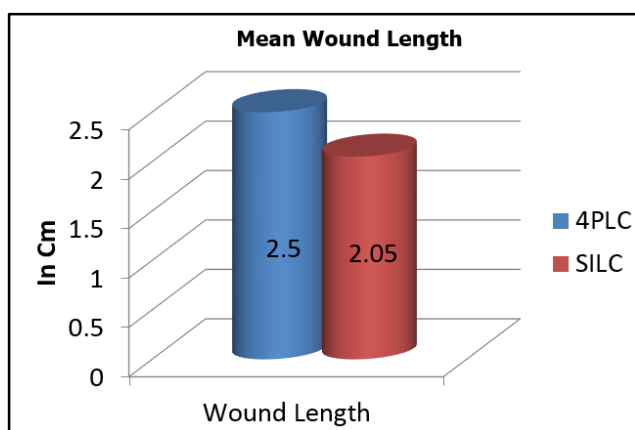


**Graph 7. Postoperative Complications**

Erythema occurred in 1 case of 4 PLC and 2 cases in SILC group; 2 cases of 4 PLC and 1 case of SILC developed seroma. Retained CBD stone was identified in 1 case in each group. There was no mortality in either group.

Procedure	Mean Wound Length (Plus or Minus SD)	P Value
4 Port Laparoscopic Cholecystectomy (4 PLC)	2.5 ± 0	P < 0.0001 (Significant)
Single Incision Laparoscopic Cholecystectomy (SILC)	2.05 ± 0.15	

**Table 9. Wound Length**



**Graph 8. Mean Wound Length**

The mean wound length of 4 PLC group is 2.5 and for those who underwent SILC is 2.05 and the P value calculated by t-test is < 0.0001, which is significant.

**Length of Hospital Stay**

The average length of hospital stay was 2 days in both 4 PLC and SILC group.

**Cost of Procedure**

The amount spent by those who underwent 4 PLC and those who underwent SILC was around Rs. 7000.

**DISCUSSION**

In our study, we have conducted a randomised controlled trial in Department of General Surgery, SCBMCH, Cuttack from July 2012 to September 2014 among 60 patients undergoing laparoscopic surgery for gallstone disease (either 4 PLC or SILC) and have compared these two methods in terms of duration of surgery, intraoperative complication and postoperative results.

**Age and Sex Distribution**

According to the observation based on table 1 and Graph 1, the peak age incidence of gallstone disease is observed between 36 - 45 years. A total of 24 males and 36 females were considered for study and the male-to-female ratio in this study is 1:1.5.

**Total Number of Cases and Procedure Undertaken**

Table 2 and Graph 2: 60 cases admitted through surgery outdoor were divided into two groups. In this process 30 cases underwent 4 PLC, 27 cases SILC and 3 cases converted from SILC to 4 PLC.

**Anaesthesia-** All the 60 patients underwent surgery under general anaesthesia in our Institution.

**Duration of Surgery-** Table 3 and Graph 3 for 4 PLC, the mean time duration was 47.1 (SD 1.9) minutes and for SILC it was 59.5 (SD 6.9) minutes.

SILC is technically more demanding, that is the probable reason behind more operative time period. The learning curve being more stiffer for SILC and the 4 PLC has got advantage over it in this aspect.

In a comparative study by Coa et al (2011), they reported a mean duration of 46.3 minutes for 4 PLC and 55.2 minutes for SILC which is corroborative to our findings.<sup>7</sup>

**Intraoperative Complications**

Table 4 and Graph 4- In our study, difficulty in Calot's dissection was encountered in 8 cases (3 in 4 PLC and 5 in SILC). Out of 5 cases of SILC, 3 cases were converted to 4 PLC.

Two studies have compared conversion rates. In Coa et al (2011) study, they reported 2 SILC required conversion, of which one was converted to 4 PLC and the other to open.<sup>7</sup> In Froghei et al (2011) study, they reported one SILC required conversion to 4 PLC.<sup>8</sup>

**Bleeding**

Table 4 and Graph 4- In our study minor intraoperative bleeding is reported in 2 cases, one in either procedure.

In the study by Froghei et al (2011), they reported intraoperative bleeding in one SILC and one 4 PLC.<sup>8</sup>

### Bile Duct Injury

Table 4 and Graph 4- In our study, there was no cases of bile duct injury in both SILC and 4 PLC.

In the study by Coa et al (2011), they have reported bile leakage in one SILC patient which was conservatively managed.<sup>7</sup>

### Postoperative Pain < 12 Hours and > 12 Hours

Table 5, 6 and Graph 5, 6- In our study, the mean postoperative pain score < 12 hrs. in 4 PLC was 5 (SD 0.4) and in SILC it was 2.5 (SD 0.4) and the P value was less than 0.0001 (Significant).

The mean postoperative pain score > 12 hrs. in 4 PLC was 2.08 (SD 0.19) and in SILC it was 2.02 (SD 0.09) and P value was not significant.

In our study, the postoperative pain < 12 hrs. in SILC patients was significantly lower than those who underwent 4 PLC. Based on 8 studies done worldwide, there is no significant difference in postoperative pain between SILC and 4 PLC at Day 1 and thereafter.<sup>7-14</sup> None of the above studies have dealt with pain score < 12 hrs.

### Other Postoperative Complications

Table 7 and Graph 7- In our study, erythema occurred in 3 cases (1 in 4 PLC and 2 in SILC), seroma in 3 cases (2 in 4 PLC and 1 in SILC), retained CBD stone in 2 cases (1 each in 4 PLC and SILC).

In the study by Phillips et al (2011), they reported seroma in 1 case of SILC and retained CBD stone in 2 cases (1 each in 4 PLC and SILC), erythema in 3 cases of SILC.<sup>10</sup>

### Wound Length

Table 8 and Graph 8- In our study, the mean wound length was 2.05 (SD 0.15) in patients who underwent SILC and 2.5 in patients who underwent 4 PLC and P value is < 0.0001 which is significant.

In two studies by Coa et al (2011) and Lai et al (2011), they reported a significant shorter length of incision in SILC patients (2.1 cm) compared to 4 PLC (2.7 cm).<sup>7,12</sup>

### Length of Hospital Stay and Cost of Procedure

The length of hospital stay in both 4 PLC and SILC patients was 2 days and the average cost of both 4 PLC and SILC procedures was Rs. 7000.

All eight studies show no significant difference regarding length of hospital stay and cost of procedure.<sup>7-14</sup>

### SUMMARY

60 cases of symptomatic gallstone disease were subjected to either method of laparoscopic cholecystectomy (4 PLC/SILC) at Department of Surgery, SCB Medical College and Hospitals. The study was prospective, randomised comparative. From June 2013 to September 2014, 30 cases of 4 PLC and 30 cases of SILC were undertaken by random selection.

After thorough investigation and pre-operative preparation, patients were subjected for surgery. Operative time, intra- and post-operative complications and recovery

were observed keenly and data recorded according to case record form.

In our study, the male-to-female ratio was 1: 1.5 with female predominance.

The peak age incidence in our study was between 36 - 45 yrs.

The average duration of surgery was significantly more in SILC group when compared with 4 PLC group, SILC requires more expertise than 4 PLC. Three cases initially subjected for SILC were converted to 4 PLC.

The incidence of intraoperative complications were similar in both groups.

Postoperative pain < 12 hrs. was significantly lower in SILC group compared to 4 PLC group. But the pain score after 12 hrs. showed no significant difference between the two groups.

Incidence of wound infection was similar in both groups.

The mean wound length was significantly short in SILC group compared to 4 PLC group. The length of hospital stay was 2 days in both SILC and 4 PLC groups. The average sum of money spent by 4 PLC and SILC group was same.

### CONCLUSION

The study ends with the conclusion that, SILC is definitely a good alternative to 4 PLC. SILC has got an advantage of decreased early postoperative pain, decreased wound length and other factors comparable to 4 PLC. The important drawback being stiff learning curve requiring more precision, more of operative time and more chance of conversion to 4 PLC.

At the end SILC is a better choice for the patient in experienced hands, but simultaneously experience in 4 PLC is inevitable.

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